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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/599,477	06/23/00	FURUHATA	

EXAMINER	
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ART UNIT	PAPER NUMBER
DICKEY, T	

024033
KONRAD RAYNES & VICTOR, LLP
315 SOUTH BEVERLY DRIVE
SUITE 210
BEVERLY HILLS CA 90212

MMC2/0925

DATE MAILED:
2826
09/25/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/599,477	FURUHATA, TOMOYUKI	
	Examiner	Art Unit	
	Thomas L Dickey	2826	

-- The MAILING DATE of this communication appears on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-23 and 25-32* is/are rejected.

7)☒ Claim(s) *6 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 August 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Oath/Declaration

1. The oath/declarations filed on 10/17/00 is acceptable.

Drawings

2. The formal drawings filed on 01/02/1998 are acceptable.

Priority

3. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on 01/02/1997. It is noted, however, that applicant has not filed a certified copy of the Japanese application as required by 35 U.S.C. 119(b).

Information Disclosure Statement

4. If applicant is aware of any relevant prior art, he/she requested to cite it on form **PTO-1449** in accordance with the guidelines set forth in M.P.E.P. 609.

Specification

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 15,22,26 and 27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 15 and 22 recites the limitation "the silicon dioxide layer" in lines 2 and 4 respectively. There is insufficient antecedent basis for this limitation in the claim.

In claim 26, line 2, "another circuit element mixed together" is unclear. How can another circuit region be mixed together with eh non-volatile memory transistor?

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims *1-5,7,9,23, and 32* are rejected under 35 U.S.C. 102(**b**) as being anticipated by HIRANO (5,652,450).

Hirano discloses a semiconductor device comprising a semiconductor substrate 11 of a first conductivity (p) type having a memory region; a first well 12 of a second conductivity (n) type located in the memory region; and a second well 14 of a first conductivity (p) type located in the first well 12, the nonvolatile memory transistor including an n-type source and drain that are located in the second well 14, the non-volatile memory transistor is operated using voltages selected from the group

consisting of positive and negative voltages, the operation includes writing and/or erasing data, writing data in the non-volatile memory transistor uses a voltage in an opposite polarity applied to the control gate, a voltage in one polarity applied to one of the source and the drain, a voltage in the opposite polarity applied to the other of the source and the drain, a voltage in the opposite polarity applied to the second well 14, and a voltage in the one polarity applied to the first well 12, and for erasing data in the non-volatile memory transistor, a voltage in the one polarity applied to the control gate, a voltage in the opposite polarity applied to one of the source and the drain, a voltage in the opposite polarity applied to the other of the source and the drain, a voltage in the opposite polarity applied to the second well 14, and a voltage in the one polarity applied to the first well 12, data is written in the non-volatile memory transistor by channel hot electrons, data is erased by Fowler Nordheim Tunneling, the non-volatile memory transistor has a first gate insulation layer, a second gate insulation layer, a floating gate, a control gate and an intermediate insulation layer functioning as a tunnel insulation layer, wherein the first gate insulation layer and the second gate insulation layer are located above the second well 14 and between one of the pair of source and drain and the other of the pair of source and drain, the floating gate is located above the first gate insulation layer, the intermediate insulation layer is located above the floating gate, and the control gate is located above the second gate insulation layer and rests on the floating gate through the intermediate insulation layer, alternatively, having a non-volatile memory transistor with a semiconductor substrate 11 of a first conductivity

(p) type having a memory region; a first well 12 of a second conductivity (n) type located in the memory region; and a second well 14 of a first conductivity (p) type located in the first well 12 wherein the non-volatile memory transistor comprises a source, a drain, and means for performing an data writing operation using a first voltage of a first polarity and a data erasing operation using a second voltage of a second polarity opposite from that of the first polarity. Note figure 3, tables 1 and 2, col. 2 ll. 9,22, col. 1 ll. 33,56,60, and col. 16 l. 34 of Hirano.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

A. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over HIRANO (5,652,450).

With regard to claim 8, Hirano discloses all the limitations except for the source and drain having an impurity concentration of 1 - 8 x 10^{20} CM^{-3}, the second well have a surface impurity concentration of 0.5 - 5 x 10^{16} CM^{-3}, and the second (sic) well (read as "first well") have a peak impurity concentration of 1 - 4 x 10^{17} CM^{-3}. Note figure 3, tables 1 and 2, col. 2 ll. 9,22, col. 1 ll. 33,56,60, and col. 16 l. 34 of Hirano. Although Hirano's device does not teach the exact impurity concentrations as that claimed by Applicant,

the concentration differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re* Leshin, 125 USPQ 416.

B. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over HIRANO (5,652,450) in view of THOMAS (6,242,773).

Hirano discloses a semiconductor memory device comprising a semiconductor substrate 11 of a first conductivity (p) type having a memory region; a first well 12 of a second conductivity (n) type located in the memory region; and a second well 14 of a first conductivity (p) type located in the first well 12, the nonvolatile memory transistor including an n-type source and drain that are located in the second well 14, a first gate insulation layer, a second gate insulation layer, a floating gate, a control gate and an intermediate insulation layer functioning as a tunnel insulation layer, wherein the first gate insulation layer and the second gate insulation layer are located above the second well 14 and between one of the pair of source and drain and the other of the pair of source and drain, the floating gate is located above the first gate insulation layer, the intermediate insulation layer is located above the floating gate, and the control gate is located above the second gate insulation layer and rests on the floating gate through the intermediate insulation layer. Note figure 3, tables 1 and 2, col. 2 ll. 9,22, col. 1 ll. 33,56,60, and col. 16 l. 34 of Hirano. Hirano does not disclose that the intermediate insulation layer is composed of at least three insulation layers, wherein a first layer of

the three insulation layers contacts the floating gate, a third layer contacts the control gate, and a second layer is located between the first and third layers.

However, Thomas discloses a non-volatile memory cell with an ONO intermediate insulation layer composed of at least three insulation layers 118 120 124, wherein a first layer 118 of the three insulation layers contacts the floating gate 116, a third layer 124 contacts the control gate 128, and a second layer 120 is located between the first and third layers 118 124. Note figure 1E of Thomas. Therefore, it would have been obvious to a person having skill in the art to replace the single layer of Hirano's memory cell with the ONO layer such as taught by Thomas in order to allow the intermediate insulation layer and the floating gate to be simultaneously patterned and self-aligned on the control gate to thus provide better more efficient manufacture.

C. Claims 10,11,16-20,25, and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over HIRANO (5,652,450) in view of NAKAMURA et al. (5,654,577) and Ito et al. (5,650,344).

Hirano discloses a semiconductor memory device comprising a semiconductor substrate 11 of a first conductivity (p) type having a memory region; a first well 12 of a second conductivity (n) type located in the memory region; and a second well 14 of a first conductivity (p) type located in the first well 12, the nonvolatile memory transistor including an n-type source and drain that are located in the second well 14, a first gate insulation layer, a second gate insulation layer, a floating gate, a control gate and an intermediate insulation layer functioning as a tunnel insulation layer, wherein the first

gate insulation layer and the second gate insulation layer are located above the second well 14 and between one of the pair of source and drain and the other of the pair of source and drain, the floating gate is located above the first gate insulation layer, the intermediate insulation layer is located above the floating gate, and the control gate is located above the second gate insulation layer and rests on the floating gate through the intermediate insulation layer. Note figure 3, tables 1 and 2, col. 2 ll. 9,22, col. 1 ll. 33,56,60, and col. 16 l. 34 of Hirano.

Hirano does not disclose that the semiconductor substrate include first, second and third transistor regions, the first transistor region including a first voltage-type transistor that operates at a first voltage level, the second transistor region including a second voltage-type transistor that operates at a second voltage level, and the third transistor region including a third voltage-type transistor that operates at a third voltage level, forming at least a flash-memory (flash EEPROM), wherein the flash memory includes a memory cell array composed of non-volatile memory transistors and peripheral circuits formed therein, and wherein the first voltage-type transistor is included in at least one circuit selected from a group consisting of a Y-gate sense amplifier, an input/output buffer, an Xaddress decoder, a Y-address decoder, an address buffer and a control circuit, the second voltage-type transistor is included in at least one circuit selected from a group consisting of a Y-gate sense amplifier, an input/output buffer, an Xaddress decoder, a Y-address decoder and an interface circuit, and the third voltage-type transistor is included in at least one circuit selected from a

group consisting of a voltage generation circuit, an erase voltage generation circuit and a step-up voltage circuit.

Further, Hirano does not disclose that the gate insulation layer of the second voltage-type transistor has at least two insulation layers and the gate insulation layer of the third voltage-type transistor has at least three insulation layers.

However, Nakamura et al. discloses a semiconductor integrated circuit device with a semiconductor substrate that includes first (input output), second (NMOS) and third (PMOS) transistor regions, the first transistor region includes a first voltage-type transistor that operates at a first voltage level, the second transistor region includes a second voltage-type transistor that operates at a second voltage level, and the third transistor region includes a third voltage-type transistor that operates at a third voltage level, forming at least a flash-memory (flash EEPROM), the flash memory including a memory cell array composed of non-volatile memory transistors and peripheral circuits formed therein, and wherein the first and second voltage-type transistor are both included in circuits forming a Y-gate sense amplifier, an input/output buffer, an Xaddress decoder, a Y-address decoder, an address buffer, and a control circuit, and the third voltage-type transistor is included in a voltage generation circuit, an erase voltage generation circuit and a step-up voltage circuit. Note figs. 1-4, col. 8 ll. 10-64, and col. 3 ll. 1-16 of Nakamura et al.

Further, Ito et al. discloses a method of making a MOSFET with a re-oxidized, nitrided gate insulation layer 21 having at least two insulation layers and in fact having three insulation layers. Note col. 1 ll. 19-20 of Ito et al.

Therefore, it would have been obvious to a person having skill in the art to augment Hirano's semiconductor memory device with the three region, three voltage peripherals such as taught by Nakamura et al., and the two and three layer onynitride and ONO gate insulators such as taught by Ito et al., in order to bias the PMOS circuitry separately from the I/O and NMOS circuitry, improving refresh rates, reducing leakage currents, protecting against undershoot, and ultimately raising peripheral circuit operation speed, and to provide better improve gate oxide quality with respect to charge generation due to high field and radiation, retard boron diffusion from boron doped polysilicon gates, increase hot electron resistance, and increase the punch through voltage.

The applicant's claims 10, 11 and 16 do not distinguish over the Ito et al. reference regardless of the process used to form the various gate insulation layers, because only the final product is relevant, not the recited processes of a single step forming the gate insulation layer of the first voltage-type transistor, one of the second voltage-type transistor gate insulation layers, and one of the third voltage-type transistor gate insulation layers and a single step forming a layer of the third voltage-type transistor gate insulation layer and a layer of the intermediate insulation layer of the non-volatile memory transistor.

Note that a "product by process" claim is directed to the product per se, no matter how actually made. In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear. See also MPEP 706.03(e).

With regard to claim 18, although Ito et al.'s device does not teach the exact thick nesses of the second voltage-type transistor gate insulation layer as that claimed by Applicant, the thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re* Leshin, 125 USPQ 416.

With regard to claims 17,19, and 20, although Hirano's device does not teach the exact thick nesses of the first voltage-type transistor gate insulation layer, third voltage-type transistor gate insulation layer, and non-volatile memory transistor intermediate insulation layer as that claimed by Applicant, the thickness differences are considered obvious design choices and are not patentable unless unobvious or

unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re* Leshin, 125 USPQ 416.

D. Claims 12-15, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over HIRANO (5,652,450) in view of NAKAMURA et al. (5,654,577), as applied to claim 11 above, and further in view of THOMAS (6,242,773).

Hirano, Ito et al., and Nakamura et al. disclose all the limitations of claims 12-15, 21 and 22 except that that the intermediate insulation layer is composed of at least three insulation layers, wherein a first layer of the three insulation layers contacts the floating gate, a third layer contacts the control gate, and a second layer is located between the first and third layers. Note figure 3, tables 1 and 2, col. 2 ll. 9,22, col. 1 ll. 33,56,60, and col. 16 l. 34 of Hirano, col. 1 ll. 19-20 of Ito et al., and figs. 1-3, col. 8 ll. 10-64, and col. 3 ll. 1-16 of Nakamura et al.

However, Thomas discloses a non-volatile memory cell with an ONO intermediate insulation layer composed of at least three insulation layers 118 120 124, wherein a first layer 118 of the three insulation layers contacts the floating gate 116, a third layer 124 contacts the control gate 128, and a second layer 120 is located between the first and third layers 118 124. Note figure 1E of Thomas. Therefore, it would have been obvious to a person having skill in the art to replace the single layer of Hirano's memory cell with the ONO layer such as taught by Thomas in order to allow the

intermediate insulation layer and the floating gate to be simultaneously patterned and self-aligned on the control gate to thus provide better more efficient manufacture.

The applicant's claims 12-15 do not distinguish over the Thomas reference regardless of the process used to form the intermediate insulation layers, the second outermost layer that contacts the control gate of the intermediate insulation layer and the gate insulation layer of the first voltage-type transistor, an insulation layer of the intermediate insulation layer, and the "silicon oxide layer" (presumed to refer to the insulation layer between first and second outer layers), because only the final product is relevant, not the recited processes of thermal oxidation method, single step, CM method, or CMP method (HTO or TEOS).

Note that a "product by process" claim is directed to the product per se, no matter how actually made. In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear. See also MPEP 706.03(e).

With regard to claims 21 and 22, although Thomas's device does not teach the exact thick nesses of the first outermost layer that forms the intermediate insulation layer of the non-volatile memory transistor, the second outermost layer, and the second layer formed between the first and the second outermost layers as that claimed by Applicant, the thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re* Leshin, 125 USPQ 416.

Allowable Subject Matter

9. Claims 26 and 27 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112 set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claims 6 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Papers related to this application may be submitted to Technology Center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 3-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989).

The Group 2826 Fax Center number is (703) 308-7722 and 308-7724. The Group 2800 Fax Center is to be used only for papers related to Group 2800 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to Thomas Dickey whose telephone number is **(703) 308-0980**. The Examiner is in the Office generally between the hours of 8:00 AM to 5:00 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**.

TLD

09/2001

Minh Loan Tran
Primary Examiner